PCT/AU2004/000497

Australian Government

REC'D 06 MAY 2004
WIPO PCT

Patent Office
Canberra

I, LEANNE MYNOTT, MANAGER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2003901784 for a patent by GRIDEX POWER PTY LTD as filed on 15 April 2003.

WITNESS my hand this
Twenty-ninth day of April 2004

LEANNE MYNOTT
MANAGER EXAMINATION SUPPORT AND SALES

AUSTRALIA

Patents Act 1990

PROVISIONAL SPECIFICATION

Applicant(s):

GRIDEX POWER PTY LTD

Invention Title:

A SYSTEM AND METHOD FOR TRANSFERRING A RESOURCE WITHIN AN AREA HAVING A PLURALITY OF REGIONS

The invention is described in the following statement:

A SYSTEM AND METHOD FOR TRANSFERRING A RESOURCE WITHIN AN AREA HAVING A PLURALITY OF REGIONS

FIELD OF THE INVENTION

The present invention relates to a system and method for transferring a resource within an area having a plurality of regions, and is of particular, but by no means exclusive, application to a decentralized resource network.

BACKGROUND OF THE INVENTION

Traditional systems used to distribute a resource, such as an electrical power system, employ a centralized architecture. In the case of an electrical power system, this means that it employs a centrally located power plant which is connected to a series of transmission lines which distribute a supply of electricity to consumers.

In the case of an electrical power system, the centralized architecture has several drawbacks including: inefficiency due to power losses in the transmission lines; difficulty in extending the system into new areas as this can require an expensive system upgrade and the purchase of land ; and is often susceptible to outages due to the centralized nature of the power plant.

The drawbacks associated with a centralized architecture can be avoided by adopting a decentralized architecture. In a decentralized architecture, an area (such as a suburb) is divided into a number of distinct regions/cells, which are typically defined by the boundaries of districts in the suburb. Each region can be, for example, bounded by a number of intersecting streets. Each region has its own generating and distribution means (for example, electricity generator) which generates and

supplies the resource to consumers located within the associated region.

In order to keep the infrastructure costs of a decentralized architecture to a minimum, it is desirable to use resource generating means which have a maximum resource output that is equal to the expected peak demand for the resource. Whilst this characteristic keeps infrastructure costs to a minimum, it does mean that a region may experience interruptions to the supply of the resource when the region's demand for the resource unexpectedly exceeds the maximum output of the resource generating means.

SUMMARY OF THE INVENTION

According to a first aspect of the present invention, there is provided a system for transferring a resource within an area having a plurality of regions, the system including:

determining means arranged to determine whether any one or more of the regions requires an amount of the resource;

requesting means arranged to issue a request to at least one of the regions for the amount of the resource; and

transferring means capable of transferring the resource from the at least one of the regions to the any one or more of the regions.

Preferably, the determining means is arranged to determine whether any one or more of the regions requires the amount of the resource by determining whether a supply of the resource is adequate for any one or more of the regions.

Preferably, the determining means is arranged to determine whether any one or more of the regions requires

the amount of the resource by determining whether a source from which the supply of the resource is obtained is operational. The determining means is also preferably arranged to determine whether the source is operational by monitoring a status of the source.

Preferably, the determining means is arranged to determine whether the supply of the resource is adequate by determining whether a demand for the resource is likely to exceed a maximum amount which the supply of the resource can provide. The determining means is also arranged to determine whether the demand exceeds the maximum amount by monitoring an output of the source.

Preferably, the determining means includes an electronic monitoring device which is arranged to collect information about the status and the output of the source, the monitoring device also being arranged to process the information in order to determine whether the demand exceeds the maximum amount, and to determine the status of the source.

Preferably, the requesting means includes a plurality of interconnected devices each of which is associated with a respective one of the regions, each of the devices being arranged to issue the request to any other devices which are connected thereto, thereby effecting issue of the request to the at least one of the regions.

Preferably, each of the devices is such that upon receiving the request they determine whether the respective one of the regions is capable of providing the amount of the resource.

Preferably, each of the devices is arranged to issue an indication that the respective one of the regions

is capable of providing the amount of the resource.

Preferably, each of the devices is arranged to determine whether the respective one of the regions has a surplus amount of the resource, to thereby effect determining of whether the respective one of the regions is capable of providing the amount of the resource.

Preferably, each of the devices is arranged to determine whether a demand for the resource in the respective one of the regions is likely to exceed a maximum amount which the supply of the resource can provide to the respective one of the regions, to thereby effect determination of whether the respective one of the regions has the surplus amount of the resource.

Preferably, the transferring means includes a plurality of links that can be arranged in a mesh topology, and which can be used to transfer the resource from the at least one of the regions to the any one or more of the regions.

Preferably, the system is arranged to be used in a decentralized architecture.

According to a second aspect of the present invention, there is provided a method for transferring a resource within an area having a plurality of regions, the method including the steps of:

determining whether any one or more of the regions requires an amount of the resource;

issuing a request to at least one of the regions for the amount of the resource; and

transferring the resource from the at least one of the regions to the any one or more of the regions.

Preferably, the step of determining whether the

any one or more of the regions requires the amount of the resource includes the step of determining whether a supply of the resource is adequate for the any one or more of the regions.

Preferably, determining whether the any one or more of the regions requires the amount of the resource includes determining whether a source from which the supply of the resource is obtained is operational. The step of determining whether the source is operational preferably includes monitoring a status of the source.

Preferably, determining whether the supply of the resource is adequate includes determining whether a demand for the resource is likely to exceed a maximum amount which the supply of the resource can provide. The step of determining whether the demand exceeds the maximum amount preferably includes monitoring an output of the source.

Preferably, determining whether the source is operational and/or whether the demand exceeds the maximum amount includes collecting information about the status and the output of the source, and processing the information in order to determine whether the demand exceeds the maximum amount and the status of the source.

Preferably, issuing the request includes determining whether the respective one of the regions is capable of providing the amount of the resource.

Preferably, issuing the request includes issuing an indication that the respective one of the regions is capable of providing the amount of the resource.

Preferably, transferring the resource includes arranging a plurality of links into a mesh topology, and using the links to transfer the resource from the at least

one of the regions to the any one or more of the regions.

According to a third aspect of the present invention, there is provided computer software which, when run on a computer system, allows a resource distribution system to carry out the steps described in the second aspect of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Notwithstanding any other embodiments which may fall within the scope of the present invention, a preferred embodiment of the present invention will now be described, by way of example only, with reference to the accompanying figures, in which figure 1 depicts a decentralized resource network which includes the preferred embodiment of the present invention.

A PREFERRED EMBODIMENT OF THE PRESENT INVENTION

Figure 1 illustrates a decentralized resource network 1 according to the preferred embodiment of the present invention. Decentralized resource networks are used to provide an area 3 with a resource such as electricity or gas. The area 3 is divided into a number of regions 5. The area 3 is, for example, a suburb, while the regions 5 are, for example, different districts within the suburb.

It is noted that figure 1 shows a number of items that are the same, and these items are marked, for example 3a, 3b, 3c, etc. In this case, the letters "a", "b", "c", etc indicate a reference to individual areas 3. In the following description, a reference to the item without the letter is a reference to all of the items. For instance, a reference to the area 3 is a reference to all the areas 3a-3e. Where a reference to only a single item is being made, this will be indicated by an explicit reference to the

corresponding letter; for example, area 3a.

Unlike traditional resource networks which employ a centralized resource generating plant, decentralized resource networks employ a plurality of resource generating plants 7. Each of the regions 5 have their own plant 7 which provides the respective region 5 with a supply of the resource. The resource available from the plants 7 is made available to consumers within the regions 5 by a distribution network 9. Where the resource is electricity, for instance, the distribution network 9 is a series of cables capable of transferring the electricity. Alternatively, where the resource is a fluid, the distribution network 9 will include a number of pipes.

One of the main advantages of a decentralized network over a centralized network is that if one of the plants 7 fail, the entire area 3 does not lose its supply of the resource - only the region 3 associated with the failed plant 7. This is because other plants 7 will continue to operate and provide their respective regions 5 with the supply of the resource.

The preferred embodiment of the present invention includes a determining means 11 which is arranged to determine whether any one or more of the regions 5 require an amount of the resource. The determining means 11 is in the form of a plurality of electronic monitoring devices (which utilise a combination of hardware and software) 11a-11e each of which is located in a respective one of the regions 5.

The determining means 11 is arranged to determine whether any of the regions 5 require the amount of the resource by ascertaining whether the regions 5 have an adequate supply of the resource and/or whether their respective plant 7 is operational. To determine whether the

regions 5 have an adequate supply of the resource, the determining means 11 determines whether each of the regions 5 is likely to have a demand for the resource which will exceed a maximum amount of the resource which the respective plants 7 can provide to the regions 5.

To carry out the previously mentioned actions, each of the plurality of electronic monitoring devices 11a-11e include a processing circuit and a sensing means which includes one or more sensors. The processing circuit and sensing means are interconnected. The sensors are such that they monitor the demand (load) placed on the respective plant 7 by the consumers in the region 5. Furthermore, the sensors monitor the operational status of the respective plant 7. The sensors collect information about the load and operational status and forwards the collected information to the processing circuit. Upon receiving the information, the processing circuit processes the information to determine whether the demand for the resource is likely to exceed the maximum amount of the resource which the plants 7 can provide, and whether the plants 7 are operational. Thus, effecting the determination of whether any one or more of the regions 5 require an amount of the resource.

The preferred embodiment of the present invention also includes a requesting means 13 which is arranged to issue a request to at least one of the regions 5. The request is such that it indicates that a region 5 within the area 3 requires an amount of the resource.

The requesting means 13 is in the form of a plurality of interconnected devices 13a-13e, each of which is located in a respective one of the regions 5. The devices 13a-13e are interconnected and are configured such that they operate as a SCADA (supervisory control and data acquisition) communications network. Each of the devices

13a-13e is also connected to a respective one of the monitoring devices 11a-11e which is located in the same region 5 thereas. The devices 13a-13e are implemented by a combination of hardware and software.

The devices 13a-13e are such that they are connected to the monitoring devices 11a-11e in order to determine whether the respective one of the regions 5 require an amount of the resource. This determination is carried out by the monitoring devices 11a-11e issuing a signal to the device 13a-13e connected thereto. Upon receiving the signal, the devices 13a-13e send a data package, which is representative of the request for the amount of theresource, to interconnected devices 13a-13e located in adjacent regions 5.

Upon receiving the data package, the devices 13a-13e determine whether their respective regions 5 are capable of supplying the amount of the resource requested. This is achieved by determining whether the region 5 has a surplus amount of the resource. If the devices 13a-13e determine that the respective region 5 does not have the surplus amount of the supply, the devices 13a-13b forward on the data package to another of the devices 13a-13b (which are located in regions 5 adjacent thereto), which in turn carries out the same steps as previously discussed. On the other hand, if any of the devices 13a-13e determine that the respective region 5 is capable of supplying the requested amount of the resource (that is, the regions has a surplus amount of the resource), the devices 13a-13e forward a data package indicating that the region 5 is capable of providing the amount of the resource. The data package, indicating that a region 5 is capable of providing the resource, is transferred across the network until it reaches the device 5 which issued the request for the resource.

The devices 13a-13e are such that they determine whether the regions 5 are capable of supplying the amount of the resource by monitoring a demand for the resource in the respective regions 5, and determining whether the demand is likely to exceed a maximum amount of the resource which the respective plants 7 can provide. This is achieved by using the sensors of the sensing means, which generates appropriate information, and a processing circuit which processes the information to determine whether the demand will exceed a maximum amount of the resource which can be provided by the plant 7.

The preferred embodiment of the present invention further includes transferring means 15 capable of transferring the resource from the at least one of the regions to the any one or more of the regions. The transferring means 15 is in a form which is suitable for transferring the resource in question. For example, if the resource is electricity, then the transferring means is a set of transmission lines. Alternatively, if the resource is gas then the transferring means is a series of pipes.

The transferring means 15 is such that is capable of establishing a link which can be used to transfer the resource between one or more regions. The transferring means 15 interacts with the devices 13a-13e such that as the data package, indicating that a region 5 is capable of providing the amount of the resource, is forwarded to the devices 13a-13e, the transferring means 15 establishes the link. Once the link has been established, the distribution network 9 is such that it transfers the resource from one region 5 in the area 3 to another region 5.

It will be appreciated that whilst the preferred embodiment is described in the context of a decentralized network architecture, the present invention will also have application to a centralized architecture which divides an

area into a plurality of regions, as is the case with a decentralized architecture. It will also be appreciated that the present invention has application in a range of resources including electricity; gas; and water.

Those skilled in the art will appreciate that the invention described herein is susceptible to variations and modifications other than those specifically described. It should be understood that the invention includes all such variations and modifications which fall within the spirit and scope of the invention.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A system for transferring a resource within an area having a plurality of regions, the system including:

determining means arranged to determine whether any one or more of the regions requires an amount of the resource;

requesting means arranged to issue a request to at least one of the regions for the amount of the resource; and

transferring means capable of transferring the resource from the at least one of the regions to the any one or more of the regions.

2. The system as claimed in claim 1, wherein the determining means is arranged to determine whether any one or more of the regions requires the amount of the resource by determining whether a supply of the resource is adequate for any one or more of the regions.

3. The system as claimed in claim 1 or 2, wherein the determining means is arranged to determine whether any one or more of the regions requires the amount of the resource by determining whether a source from which the supply of the resource is obtained is operational.

4. The system as claimed in claim 2, wherein the determining means is arranged to determine whether the supply of the resource is adequate by determining whether a demand for the resource is likely to exceed a maximum amount which the supply of the resource can provide.

5. The system as claimed in claim 3, wherein the determining means is arranged to determining whether the source is operational by monitoring a status of the source.

6. The system as claimed in claim 4, wherein the determining means determines whether the demand exceeds the maximum amount by monitoring an output of the source.

7. The system as claimed in claim 6, wherein the determining means includes an electronic monitoring device which is capable of collecting information about the status and the output of the source, the monitoring device being capable of processing the information in order to determine whether the demand exceeds the maximum amount and the status of the source.

8. The system as claimed in any one of the preceding claims, wherein the requesting means includes a plurality of interconnected devices each of which is associated with a respective one of the regions, each of the devices being capable of issuing the request to any other devices which are connected thereto, thereby effecting issue of the request to the at least one of the regions.

9. The system as claimed in claim 8, wherein each of the devices is such that upon receiving the request they determine whether the respective one of the regions is capable of providing the amount of the resource.

10. The system as claimed in claim 8 or 9, wherein each of the devices is capable of issuing an indication that the respective one of the regions is capable of providing the amount of the resource.

11. The system as claimed in any one of the claims 8-10, wherein each of the devices is capable of determining whether the respective one of the regions has a surplus amount of the resource, to thereby effect determining of whether the respective one of the regions is

capable of providing the amount of the resource.

12. The system as claimed in claim 11, wherein each of the devices is capable of determining whether a demand for the resource in the respective one of the regions is likely to exceed a maximum amount which the supply of the resource can provide to the respective one of the regions, to thereby effect determination of whether the respective one of the regions has the surplus amount of the resource.

13. The system as claimed in any one of the preceding claims, wherein the transferring means includes a plurality of links which are arranged in a mesh topology, and which can be used to transfer the resource from the at least one of the regions to the any one or more of the regions.

14. A method for transferring a resource within an area having a plurality of regions, the method including the steps:

determining whether any one or more of the regions requires an amount of the resource;

issuing a request to at least one of the regions for the amount of the resource; and

transferring the resource from the at least one of the regions to the any one or more of the regions any one or more of the regions to the first of the regions.

15. The method as claimed in claim 14, wherein determining whether the any one or more of the regions requires the amount of the resource includes determining whether a supply of the resource is adequate for the any one or more of the regions.

16. The method as claimed in claims 14 or 15, wherein determining whether the any one or more of the

regions requires the amount of the resource includes determining whether a source from which the supply of the resource is obtained is operational.

17. The method as claimed in claim 15, wherein determining whether the supply of the resource is adequate includes determining whether a demand for the resource is likely to exceed a maximum amount which the supply of the resource can provide.

18. The method as claimed in claim 16, wherein determining whether the source is operational includes monitoring a status of the source.

19. The method as claimed in claim 17, wherein determining whether the demand exceeds the maximum amount includes monitoring an output of the source.

20. The method as claimed in claim 19, wherein determining whether the source is operational and/or whether the demand exceeds the maximum amount includes collecting information about the status and the output of the source, and processing the information in order to determine whether the demand exceeds the maximum amount and the status of the source.

21. The method as claimed in any one of claims 14-20, wherein issuing the request includes determining whether the respective one of the regions is capable of providing the amount of the resource.

22. The method as claimed in any one of claims 14-21, wherein issuing the request includes issuing an indication that the respective one of the regions is capable of providing the amount of the resource.

23. The method as claimed in any one of claims

14-22, wherein transferring the resource includes arranging a plurality of links into a mesh topology, and using the links to transfer the resource from the at least one of the regions to the any one or more of the regions

24. Computer software which, when run on a computer system, allows a resource distribution system to carry out the steps according to any one of claims 14-23.

DATED this 15th Day of April 2003
GRIDEX POWER PTY LTD
By their Patent Attorneys
GRIFFITH HACK

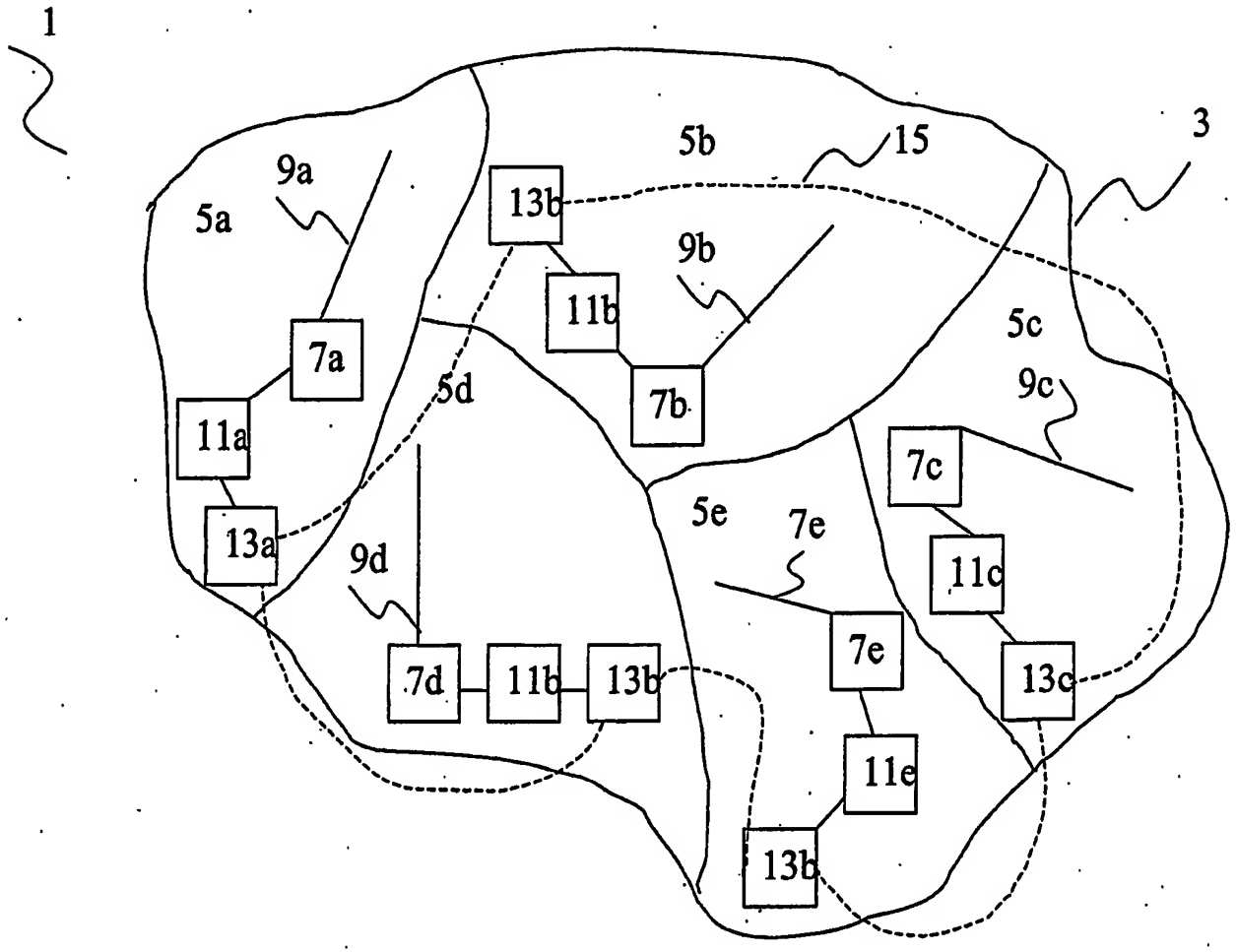
1
3
5a
9a
5b
15
13b
9b
11b
7a
5d
7b
5c
9c
11a
7c
13a
5e
7e
9d
11c
7e
7d
11b
13b
13c
11e
13b

Figure 1

This Page is Inserted by IFW Indexing and Scanning Operations and is not part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☑ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☑ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☐ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.
As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.